# The Effectiveness of Using Anonymous and Personal Identifiable Agents in Computer-Supported Collaborative Learning on Self-Regulated Learning and Team Projects Execution

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## Abstract

The aim of this study was to investigate the effectiveness of anonymous and personal identifiable agents of pre-service teacher students among students learning in terms of self-regulated learning which combined motivation scales and learning strategies scales, team collaboration, and team projects execution on Computer-Supported Collaborative Learning (CSCL). There were 451 students who participated in this study and 198 was successfully completed. The data were analyzed and interpreted by using various statistical techniques (t-test and ANOVA). The result showed the outcome of using anonymous and personal identifiable agents on CSCL affected self-regulated learning and team collaboration toward team project execution. There was an interaction in motivation (Extrinsic Goal Orientations: EGO), learning strategies (Critical Thinking: CT and Help Seeking: HS). However no interaction in team collaboration towards team projects execution when students used different agents for representatives on CSCL. This results to helped teachers or instructional designers in developing eLearning courseware which cooperated with project-based learning (PjBL) techniques.

**Keywords:** Anonymous and Personal Identifiable Agents, Computer-Supported Collaborative Learning (CSCL), Self-Regulated Learning, Team Projects

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## Introduction and Related Literatures

The use of Information and Communication Technology (ICT) in education has emphasized emotional and cognitive process in the acquisition and development of knowledge and specific competences (Dellit, 2001). In order to acquire and develop students'competence in a disciplinary area, student should have a solid base of verified knowledge, understanding of facts and ideas in the context of a conceptual construction, and the ability to organize their knowledge in a way which will facilitate retrieval and application. The metacognition is an aspect of students' learning strategies within the theory of Self-Regulated Learning (SRL). Metacognition could help students to define their goals and objectives, to monitor their learning process, and to evaluate their progress. Moreover, students need the opportunity to learn in depth and through comprehension of a topic in order to transform basic information into usable knowledge (Succi and Cerbo, 2005). Moreover, on the challenges in teaching and learning is how to effectively communicate course materials to students in the most appropriate way. It is desirable that the learning materials should be clear and concise. In addition, they should be informative as regard to all the activities and how they are related to the student's study. Ideally, from the students' perspective, the learning process and experience should be enjoyable so that it could lead to effective communication and learning (Kilic-Cakmak, 2010). An understanding of anonymous avatar in Computer-Supported Collaborative Learning (CSCL) in influencing students' motivation and learning strategies and creation of team learning in project development can assist the E-Learning developer, educator and researcher in using ICT in distance education or instructional technologist in business setting to design and develop the suitable environment and activities in Computer-Supported Collaborative Learning (CSCL) Environment. This study focuses on the psychological aspects such as behaviorism and constructivism theory, web technology as the development of Computer-Supported Collaborative Learning (CSCL), using anonymous and avatar in education, team learning, and the project-based learning will use as the teaching method to develop and plan for learning activities in each step of study because both control and experimental group have to study in the same environment on the web but different representative to produce project. The idea of anonymity on the internet means that the real author of a messenger is not shown (Palme and Berglund, 2007). Blau and Caspi (2008) found that in an online environment may enhance students' participation. In addition, visual anonymity and isolation from other students may decrease fear of criticism, which consequently both enhances participation and lead to a more risky behavior. It is related to the Social Identity model of Deindividuation Effects (SIDE) theory which claims that anonymity induces a shift in an individual' s focus from their personal identity

toward their social identity as a member of a group. Also, visual anonymity combined with salient group identity increase the adherence to group norms and causes greater attraction o the groups' member (Blau and Caspi, 2008).

## Methodology and Results

The objective of investigate the effectiveness of anonymous and personal identifiable agents used of pre-service teacher students among student learning in term of self-regulated learning which combined of motivation scales and learning strategies scales, and team projects execution on Computer-Supported Collaborative Learning (CSCL). This research combined with framework, stages, population and sample groups, and research procedures for collecting data, research materials such as CSCL, MSLQ, and learning management plans. It also address the data and statistics procedures in this research to analyses differentiate of students who take place in different identity and the execution of team projects. There are 451 pre-service teacher students will participate in this study as the sample group. They will divide into 2 groups by using Non-Randomized Control Group Design technique because of the limitation of random into both experimental and control groups are not totally matched. However, each group was expected to have similar academic performance and computer skills and the Independent Sample T-Test will be calculate for pre-test to check both group are not different by 0.05 level of significant. If there are any different has occur that factor or variable will be remove, or re-group. The 198 students totally completed all stages of this research and proceed to analyses by using Independent T-Test of pre/ post-test and One way ANOVA. The results of the effectiveness of anonymous and personal identifiable agents used of pre-service teachers undergraduate students among student learning in term of self-regulated learning which combined of motivation scales (6 subscales) and learning strategies scales (9 subscales). The data were analyzed and interpreted by using various statistical techniques such as using independent sample t-test to test the differentiated of two groups for pretest and there was not significantly different ($p > .05$) which can used to next step of analysis. There was an interaction effect between used of different agents and execution of team projects on motivation scales (EGO), learning strategies scales (CT and HS). Table 1 shows the summary of finding on number of students and groups of students in team projects execution.

**Table 1** Summary of team project finding

| Agents | Completed | Not Completed | TOTAL |
|---|---|---|---|
| **AA** | N = 57 (28.80%)<br>13 groups (28.26%) | N = 49 (24.75%)<br>11 groups (23.90%) | N = 108 (53.55%)<br>24 groups (52.16%) |
| **PIA** | N = 29 (14.65%)<br>7 groups (15.19%) | N = 63 (31.80%)<br>15 groups (32.65%) | N = 92 (46.45%)<br>22 groups (47.84%) |
| **TOTAL** | N = 84 (43.45%)<br>20 groups (43.45%) | N = 112 (56.55%)<br>26 groups (64.45%) | N = 198 (100%)<br>49 groups (100%) |

There were results as follows: 1) using anonymous agents: there were a great number in completed projects (57 students, 28.80%) followed by not completed projects (49 students, 24.75%). This means that using AA could encourage students' team project completion; 2) using personal identifiable agents: there was a great number in not completed projects (63 students, 32.65%) followed by completed projects (29 students, 15.19%). This could imply that using PIA could not encourage students' team project completion; 3) the highest number of students after actual experiment was PIAF (63 students, 32.65%), AAS (57 students, 28.80%), AAF (49 students, 24.75%), and PIAF (29 students, 15.19%) respectively. This could imply that the PIA is not encouraging students' team project completion which contrasts to using AA that will encourage students' team project completion. However, the discussion in Chapter will explain more information and discuss the associated variables that conclusion this findings, and 4) the most population number of students in each group is 4 students (60.87%) followed by 5 students (28.27%), 3 students (6.52%), and 6 students (4.34%) respectively. Comparing the group member in completed team projects, there was 13 groups in 4 members (AA = 7 groups, PIA = 6 groups) and 6 groups in 5 members (AA = 4 groups, PIA = 1 group). This means that the suitable number is 4 students in each group when student assigned to work as a team and intend to complete the team projects in online learning environment.

**Table 2** Summary of One Way ANOVA of Motivation and Learning Strategies

| | Sum of Squares Between/ Within Groups | df Between / Within Groups | Mean Square Between/ Within Groups | F | Sig. |
|---|---|---|---|---|---|
| **Motivation** | | | | | |
| IGO | 114.523/ 2983.457 | 3/194 | 38.174/ 15.379 | 2.482 | .062 |
| EGO | 2540.043/ 4151.775 | 3/194 | 846.681/ 21.401 | 39.563 | .000* |
| TV | 693.158/ 5437.185 | 3/194 | 231.053/ 28.027 | 8.244 | .000* |
| CLB | 51.118/ 2796.362 | 3/194 | 17.039/ 14.414 | 1.182 | .318 |
| SE | 1936.041/ 9185.272 | 3/194 | 645.347/ 47.347 | 13.630 | .000* |
| TA | 116.270/ 7923.103 | 3/194 | 38.757/ 40.841 | .949 | .418 |
| **Learning Strategies** | | | | | |
| Reh | 169.011/ 2518.545 | 3/194 | 56.337/ 56.337 | 4.340 | .006* |
| Elab | 705.492/ 4669.261 | 3/194 | 235.164/ 24.068 | 9.771 | .000** |
| Org | 269.337/ 2215.026 | 3/194 | 89.779/ 11.418 | 7.863 | .000** |
| CT | 375.456/ 3513.296 | 3/194 | 125.152/ 18.110 | 6.911 | .000** |
| MC | 1611.189/ 13447.457 | 3/194 | 537.063/ 69.317 | 7.748 | .000** |
| TSE | 527.940/ 5763.554 | 3/194 | 175.980/ 29.709 | 5.923 | .001* |
| ER | 74.567/ 1856.262 | 3/194 | 24.856/ 9.568 | 2.598 | .054 |
| PL | 104.716/ 1357.445 | 3/194 | 34.905/ 6.997 | 4.989 | .002* |
| HS | 215.669/ 2428.008 | 3/194 | 71.890/ 12.516 | 5.744 | .001* |
| ***P<0.01/ **P<0.001** | | | | | |

The one way ANOVA was used to review the differentiated between four groups (AAS, AAF, PIAS, and PIAF). The results show (as in Table 2) the significant difference of motivation, learning strategies, and team collaboration when students used different agents in representative at $P<0.01$ and $P<0.001$ except Control of Learning Belief: CLB and Effort Regulation: ER.

## On Motivation subscale

The ANOVA table revealed that there were no significant differences in gained scores on motivation subscale between AAS, AAF, PIAS, and PIAF Group on the IGO, $F(3, 194) = 2.482$, $p = .062$; CLB, $F(3, 194) = 1.182$, $p = .318$; and TA, $F(3, 194) = .949$, $p = .418$. However, there were significant difference on the gained scores of EGO, $F(3, 194) = 39.563$, $p < .001$; TV, $F(3, 194) = 8.244$, $p < .001$; SE, $F(3, 194) = 13.63$, $p < .001$; and overall, $F(3, 194) = 8.95$, $p < .001$.

Post hoc tests were carried out in order to investigate further where the differences occurred between each of the agents used on these six motivation subscales.

IGO (Intrinsic Goal Orientation): There were no significant differences across the used of different agents in term of Intrinsic Goal Orientation ($p > .05$), therefore, no post hoc tests were used.

EGO (Extrinsic Goal Orientation): Scheffe post-hoc comparisons of the four groups indicate that the PIAS ($M = 30.24$, $SD = 4.73$) gave significantly higher ratings for Extrinsic Goal Orientation than AAS ($p = .000$, $M = 20.30$, $SD = 4.74$), AAF ($p = .000$, $M = 21.02$, $SD = 3.70$), and PIAF ($p = .000$, $M = 19.56$, $SD = 5.09$). This means that students in PIAS group have higher level of Extrinsic Goal Orientation than students in AAS, AAF, and PIAF group.

TV (Task Value): Scheffe post-hoc comparisons of the four groups indicate that the AAS ($M = 33.14$, $SD = 4.14$) gave significantly higher ratings for Task Value than PIAF ($p = .004$, $M = 29.54$, $SD = 6.44$) and AAF ($M = 33.82$, $SD = 5.15$) gave significantly higher ratings for Task Value than PIAS ($p = .043$, $M = 30.24$, $SD = 4.73$) and PIAF ($p = .001$, $M = 29.54$, $SD = 6.44$). This means that students in AAF groups have higher level of Task Value than students in PIAS and PIAF group with statistically different and have no significant differences for students in AAS group.

CLB (Control of Learning Beliefs): There were no significant differences across the use of different agents in term of Control of Learning Beliefs ($p > .05$). Therefore, no post hoc tests were used.

SE (Self-Efficacy): Scheffe post-hoc comparisons of the four groups indicate that the AAS ($M = 43.19$, $SD = 5.59$) gave significantly higher ratings for Self-Efficacy than PIAS ($p = .016$, $M = 38.10$, $SD = 7.06$), PIAF ($p = .000$, $M = 36.51$, $SD = 8.27$), and AAF ($M = 43.20$, $SD = 6.11$) gave significantly higher ratings for Self-Efficacy than PIAS ($p = .020$, $M = 38.10$, $SD = 7.06$), PIAF ($p = .000$, $M = 36.51$, $SD = 8.27$). This means that students in AAF group have higher level of Self-Efficacy than students in PIAS and PIAF group with significant difference and without significant difference in AAS group.

TA (Test Anxiety): There were no significant differences across the use of different agents in terms of Test Anxiety ($p > .05$). Therefore, no post hoc tests were used

## On Learning Strategies subscale

The ANOVA table revealed that there were significant differences in gained scores on learning strategies between AAS, AAF, PIAS, and PIAF Group on the overall, $F(3, 194) = 10.725$, $p < .001$; Reh, $F(3, 194) = 4.34$, $p < .001$; Elab, $F(3, 194) = 9.771$, $p < .001$; Org, $F(3, 194) = 7.863$, $p < .001$; CT, $F(3, 194) = 6.911$, $p <$

.001; MC, F(3, 194) = 7.748, p < .001; TSE, F(3, 194) = 5.923, p = .001; PL, F(3, 194) = 4.989, p = .002; and HS, F(3, 194) = 5.744, p = .001. However, there were no significant difference on the gained scores of ER, F(3, 194) = 2.598, p = .054.

Post hoc tests were carried out in order to investigate further where the differences occurred between each of the agents used on these nine Learning Strategies subscales.

Reh (Rehearsal Strategies): Scheffe post-hoc comparisons of the four groups indicate that the AAF (M = 18.29, SD = 3.53) gave significantly higher ratings for Rehearsal Strategies than PIAF (p = .01, M = 15.95, SD = 4.01), and have higher rating than AAS (M = 17.58, SD = 3.17), and PIAS (M = 16.72, SD = 3.57) without significant differences. This means that students in AAF group have higher level of Rehearsal Strategies than students in PIAF with significant difference and without significant difference in AAS and PIAF group.

Elab (Elaboration Strategies): Scheffe post-hoc comparisons of the four groups indicate that the AAS (M = 29.68, SD = 3.84) gave significantly higher ratings for Elaboration Strategies than PIAF (p = .000, M = 25.37, SD = 6.22). AAF (M = 29.47, SD = 4.37) gave significantly higher rating than PIAF (p = .000, M = 25.37, SD = 6.22). This means that students in AAF group have higher level of Elaboration Strategies than students in PIAF with significant difference and without significant difference in AAS and PIAS group.

Org (Organization Strategies): Scheffe post-hoc comparisons of the four groups indicate that the AAS (M = 18.79, SD = 2.97) gave significantly higher ratings for Organization Strategies than PIAF (p = .000, M = 16.13, SD = 3.45). AAF (M = 18.67, SD = 3.75) gave significantly higher rating than PIAF (p = .002, M = 16.13, SD = 3.45). This means that students in AAS group have higher level of Organization Strategies than students in PIAF with significant difference and without significant difference in AAS and PIAS group, and students in AAF group have higher level of Organization Strategies than students in PIAF with significant difference.

CT (Critical Thinking Strategies): Scheffe post-hoc comparisons of the four groups indicate that the AAF (M = 24.43, SD = 3.67) gave significantly higher ratings for Critical Thinking Strategies than PIAF (p = .001, M = 21.05, SD = 5.02). AAS (M = 23.79, SD = 3.67) gave significantly higher rating than PIAF (p = .007, M = 21.05, SD = 5.02). This means that students in AAF group have higher level of Critical Thinking Strategies than students in PIAF with significant difference and without significant difference in AAS and PIAS group, and students in AAS group have higher level of Critical Thinking Strategies than students in PIAF with significant difference.

MC (Metacognitive Strategies): Scheffe post-hoc comparisons of the four groups indicate that the AAS (M = 56.53, SD = 7.41) gave significantly higher ratings for Metacognitive Strategies than PIAF (p = .000, M = 49.75, SD = 6.01). AAF (M = 55.29, SD = 7.96) gave significantly higher rating than PIAF (p = .008, M = 49.75, SD = 6.01). This means that students in AAS group have higher level of Metacognitive Strategies than students in PIAF with significant difference and without significant difference in AAF and PIAS group, and students in AAF group have higher level of Metacognitive Strategies than students in PIAF with significant difference.

TSE (Time and Study Environment Strategies): Scheffe post-hoc comparisons of the four groups indicate that the AAS (M = 39.19, SD = 5.10) gave significantly higher ratings for Time and Study Environment Strategies than PIAF (p = .008, M = 35.70, SD = 6.56). AAF (M = 38.80, SD = 4.56) gave significantly higher rating than PIAF (p = .033, M = 35.70, SD = 6.56). This means that students in AAS group have higher level of Time and Study Environment Strategies than students in PIAF with significant difference and without significant difference in AAF and PIAS group, and students in AAF group have higher level of Time and Study Environment Strategies than students in PIAF with significant difference.

ER (Effort Regulation Strategies): there were no significant differences across the used of different agents in term of Effort Regulation Strategies (p > .05), therefore, no post hoc tests were used.

PL (Peer Learning Strategies): Scheffe post-hoc comparisons of the four groups indicate that the AAF (M = 14.88, SD = 2.44) gave significantly higher ratings for Peer Learning Strategies than PIAF (p = .016, M = 13.24, SD = 3.03). AAS (M = 14.84, SD = 2.27) gave significantly higher rating than PIAF (p = .013, M = 13.24, SD = 3.03). This means that students in AAF group have higher level of Peer Learning Strategies than students in PIAF with significant difference and without significant difference in AAS and PIAS group, and students in AAS group have higher level of Peer Learning Strategies than students in PIAF with significant difference.

HS (Help Seeking Strategies): Scheffe post-hoc comparisons of the four groups indicate that the AAF (M = 20.51, SD = 3.66) gave significantly higher ratings for Help Seeking Strategies than PIAF (p = .003, M = 17.94, SD = 3.87). AAS (M = 20.51, SD = 3.66) gave significantly higher rating than PIAF (p = .003, M = 17.94, SD = 3.87). This means that students in AAF group have higher level of Help Seeking Strategies than students in PIAF with significant difference and without significant difference in AAS and PIAS group, and students in AAS group have higher level of Help Seeking Strategies than students in PIAF with significant difference.

## Discussion and Conclusion

From the ANOVA, there was extrinsic goal orientation, task value, and self-efficacy showed the statistically significant difference among groups. It may be because the motivation refers to goal orientation that encourage a person to complete a task or pursue a goal (Wolters and Rosenthal, 2000) which consists of intrinsic goal orientation and extrinsic goal orientation. From the results, the intrinsic goal orientation encouraged students to complete team projects especially students in anonymous agents and completed team projects group because students may feel that using anonymous agents were challenging goals, enjoyment and new thing to used. This was similar to study of Wolters and Rosenthal (2000) who found that students who believed that learning activities were important and useful were more likely to make an effort and encouragement to completing the learning activities. However, students who used PIA may feel that if they completed team projects they will get some rewards (Davis, Bagozzi, and Warshaw, 1992). So that, teachers should design activities that remind the students motivate and concentrate in their task and learning process then students will complete their study. The multiple regression analysis showed the negative effect on extrinsic goal orientation of students in PIAS group. It may discuss that extrinsic goal orientation plays important role than intrinsic goal orientation in using personal identifiable agents which is when teachers would like students to learning face to face, they should encourage extrinsic goal orientation to be good approach to persuade learners participate and learned by project based learning in CSCL. Students who used anonymous agents and completed team projects were more likely used of task value and self-efficacy than other three groups. This may be because the student percept about using anonymous agents and their learning tasks can effort their team project execution. Students believed that using anonymous agents was the important variable which can affect students to complete the learning tasks. According to Pajares (2002) who noted that the self-efficacy was the importance of factor in improving students' learning and academic success which is similarity to these results. It shows that students in anonymous agents and completed team projects group feel that they have ability to plan and execute actions in leading to complete team projects, and students in this group have improved score on self-efficacy, this refers to students in anonymous agents and completed team projects group feel that anonymous agents is useful to them. This is converse to the score on test anxiety which using anonymous agent could not affect this factor. This may conclude that, students in anonymous agents group feel that they did not feel stressful on the test because they hided themselves from others. However students in personal identifiable agents feel that it is very stress when they have to do because they show their identity on the CSCL.

There was 5 learning strategy subscales: critical thinking strategies, metacognitive self-regulation strategies, time and study environment strategies, effort regulation strategies, and peer learning strategies of AAS group gave high improvement among the others 3 groups (AAF, PIAS, and PIAF) while 4 learning strategies subscales: rehearsal strategies, elaboration strategies, organizational strategies, and help seeking strategies of PIAS group gave high improvement among the others 3 groups (AAS, AAF, and PIAF). The results show that students who used anonymous agents both of completed and not completed team projects have higher scores on all learning strategies scales those students using personal identifiable agents. This may discuss that the use of anonymity could encourage students' learning strategies because students may feel that they decrease social pressure, express themselves freely (Bornstein, 1993), and removes interpersonal cues (Walther, 1992) which increase group ideas and enhance participation (Nunamaker, Dennis, Valacich, and George., 1991). In some subscales of learning strategies which AAF group has higher scores on posttest than AAS group such as rehearsal strategies, critical thinking strategies, and effort regulation strategies because the scores on pretest of AAS group were lower than scores on pretest of AAF group. However, only four subscales on AAS group have statistical significant different. There were metacognitive strategies, time and study environment strategies, effort regulation strategies, and peer learning strategies. The study of Liaw (2004) showed that the eLearning provides users more opportunities to be active learners which students can control their learning time and complete their course. In this study, the use of CSCL allowed students to learn in anytime and anywhere, however the used of lesson plans might help students as a learning guidelines for students who completed team projects. The test of Two-way ANOVA showed that critical thinking and help seeking have interaction with the execution of team projects, and One-way ANOVA also showed the different among four groups (AAS, AAF, PIAS, and PIAF) with statistical significant. This may discuss that using anonymous could maintain students SRL which SRL is very important in learning outcomes because it predicts student academic achievement (Fredrick, Blumenfeld, and Paris, 2004) and students with limited SRL skills would not learn much from eLearning (Byers, 2000; Picciano, 2002).

This study explores the effectiveness of using anonymous and personal identifiable agents in Computer Supported Collaborative Learning (CSCL) to facilitate students' self-regulated learning. The main results concerned that using

anonymous agent could encourage motivation and learning strategies in team project execution. There were 13 groups taking part in anonymous agents completed team projects while 11 groups not completed. However, there were 7 groups taking part in personal identifiable agents completed team projects while 26 groups not completed. There was an interaction between using different agents and execution of team projects in extrinsic goal orientation, critical thinking strategies, and help seeking strategies. Focusing on differentiation, there were different between using agents and execution of team projects on extrinsic goal orientation, task value, self-efficacy, rehearsal strategies, elaboration strategies, organizational strategies, critical thinking strategies, metacognitive self-regulation strategies, time and study environment strategies, peer learning strategies, help seeking strategies.Focusing on differentiation, there were different between using agents and execution of team projects on extrinsic goal orientation, task value, self-efficacy, rehearsal strategies, elaboration strategies, organizational strategies, critical thinking strategies, metacognitive self-regulation strategies, time and study environment strategies, peer learning strategies, help seeking strategies. There were extrinsic goal orientation which is one motivation subscale encourage the success of projects in using personal identifiable agents, and effort regulation strategies which is one of learning strategies subscale encourage the success of projects in using anonymous agents.

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